

METHOD AND SYSTEM FOR DECENTRALIZED ORDER MATCHING AMONG INDIVIDUAL MARKETPLACES

CROSS-REFERENCE TO RELATED APPLICATIONS

The present invention is related to the subject matter of co-pending patent
5 application serial number XXXX (Docket Number YOR9-2000-0493-US1) entitled
“CENTRALIZED ORDER BOOK SYSTEM AND METHOD”, assigned to the
assignee herein named, filed on XXXX and incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field:

10 The present invention relates in general to apparatus and methods for
providing decentralized order matching among separate, individual marketplaces.
More particularly, the present invention provides apparatus and methods for
bilaterally clearing orders among separate, individual marketplaces.

2. Description of Related Art:

15 Individual marketplaces are known for matching and clearing orders. An
individual marketplace maintains its own, local order book for clearing orders. A
“marketplace” is an entity, such as an auction, which matches buyers and sellers to
clear orders. A potential buyer may post a buy order in the local order book.
Similarly, a potential seller may post a sell order in the local order book. The
20 individual marketplace is then responsible for attempting to clear these orders by
matching them with other orders which are posted in the local order book.

Large marketplaces have the advantage of bringing together greater numbers
of buyers and sellers, thus increasing the potential to clear a large number of
transactions. This reduces the operating costs of the marketplace, and thus the costs
25 to the buyers and sellers.

In practice, however, multiple marketplaces generally exist for a given set of goods or services, often with different sets of buyers and sellers. This can limit the potential for individual marketplaces to clear a large number of orders.

Therefore, a need exists for a method and system for bilaterally clearing orders
5 from separate, individual marketplaces.

SUMMARY OF THE INVENTION

A method and system are described for decentralized order matching among multiple different, individual marketplaces. An order is first received within one of the individual marketplaces, an originating marketplace. Information about the order
5 is then transmitted to other individual marketplaces. Each of the individual marketplaces which received the information about the order, the receiving marketplaces, then determines whether that individual marketplace can match the order with at least one matching order posted in the receiving marketplace's order book. In response to a determination that one of the receiving marketplaces can
10 match the received order, the received order is cleared from the originating marketplace and the matching order is cleared from the receiving marketplace's order book.

The above as well as additional objectives, features, and advantages of the present invention will become apparent in the following detailed written description.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1 is a diagram illustrating a distributed data processing system according to the present invention;

Figure 2 is an exemplary block diagram of a server according to the present invention;

Figure 3 is an exemplary block diagram of a client according to the present invention;

Figure 4 illustrates a high level flow chart which depicts establishing a prioritized list of preferred providers for an individual marketplace in accordance with the present invention;

Figure 5 depicts a high level flow chart which illustrates an individual marketplace receiving an order from a customer and attempting to clear the order utilizing other individual marketplaces in accordance with the present invention; and

Figure 6 illustrates a high level flow chart which depicts an individual marketplace attempting to clear orders received from another individual marketplace in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention and its advantages are better understood by referring to Figures 1-6 of the drawings, like numerals being used for like and corresponding parts of the accompanying drawings.

5 The invention is preferably realized using a well-known computing platform, such as an IBM RS/6000 workstation running the IBM AIX operating system. However, it may be realized in other popular computer system platforms, such as an IBM personal computer running the Microsoft Windows operating system or a Sun Microsystems workstation running alternate operating systems such as UNIX or
10 LINUX, without departing from the spirit and scope of the invention.

 The present invention is a method and system for decentralized order matching among separate, individual marketplaces. An order is first received and posted in a local order book of one of the individual marketplaces, called an originating marketplace. Information about the order is then transmitted from the
15 originating marketplace to other marketplaces, called receiving marketplaces. Each of the receiving marketplaces then determines whether it can match the received order with one or more matching orders posted in the receiving marketplace's local order book. In response to a determination that one of the receiving marketplaces can match the received order, the received order is cleared from the originating
20 marketplace's order book and the matching order(s) are cleared from the order book of the receiving marketplace.

 An order book attempts to match a posted order with a "best" matching order. The order book may utilize any known method for determining which order is a "best" matching order. In addition, the marketplaces may all use the same method, or
25 the marketplaces may each use a different method for determining matches.

 In some cases the "best" matching order is actually a combination of orders. In these cases, the "best" matching order is more than one order. For example, a buyer may post an order to buy five cars of a particular model at \$20,000 each. This

order may be matched with one order to sell two of this car model at \$18,000 with another order to sell six of this model at \$19,000. The “best” match for the buy order is two cars at \$18,000 each and three cars at \$19,000 each.

5 A “best” matching order may be determined using the price of an order, its queue position, the identity of the originating marketplace, and/or any other suitable criteria.

As an order is posted in the local order book of each individual marketplace, the individual marketplace first attempts to clear the order locally using the marketplace’s own, local order book. If the originating marketplace cannot clear the
10 order locally, the originating marketplace then transmits information about the order to other, different marketplaces.

Preferred provider marketplaces may be specified for a particular marketplace. The preferred providers also may be prioritized. When preferred providers exist and when the marketplace is unable to match an order using its own, local order book, the
15 marketplace will first transmit information about the received order to the preferred providers, according to an existing priority scheme. If none of the specified preferred providers can match the received order, the originating marketplace will transmit information about the order to all of the remaining marketplaces.

The originating marketplace may then receive information about one or more
20 matching orders from one or more other marketplaces. The originating marketplace may then screen out matching orders from non-approved marketplaces. The originating marketplace may then select a best order from the remaining matching orders. The originating marketplace will then transmit a notice to the other marketplace which specifies the selected order. The originating marketplace will then
25 wait for a confirmation. If a confirmation is received from the other marketplace, the originating marketplace will clear the order from its local order book. If the originating marketplace does not receive a confirmation, the originating marketplace will then remove this selected order from the matching orders and select a best matching order from any remaining orders. If no matching orders are reported to the

originating marketplace, the originating marketplace will unlock the order in its local order book.

When a receiving marketplace is able to match an order, the receiving marketplace will select all orders posted in its local order book which match the product of the received order. All of the selected orders are then locked. The receiving marketplace will then transmit information about each of the selected orders to the originating marketplace. If the receiving marketplace receives a specification of one of these orders, the receiving marketplace will unlock all of the selected, locked orders and clear the order in its local order book which was specified. The receiving marketplace will then transmit a confirmation to the originating marketplace that the order(s) were cleared. If the receiving marketplace does not receive a specification of an order, the receiving marketplace will then unlock all selected orders.

In the preferred embodiment, the various individual marketplaces exist within computer systems which are coupled to each other using a network, such as the Internet. These marketplaces may exist within a single computer system, but are typically each implemented in different computer systems.

The individual marketplaces are entities which are capable of matching buyers and sellers. In a preferred embodiment, these marketplaces are auctions, typically Internet auction sites. The individual marketplaces may be any combination of one or more types of auctions, such as reverse auctions, multi-sided auctions, and/or call auctions.

In the preferred embodiment, each marketplace is an on-line auction site maintained on a computer system which is coupled to the Internet. Potential buyers and sellers are permitted to access the auction site and post their orders. The auction site then matches buyers and sellers in order to clear orders.

With reference now to the figures, and in particular with reference to **Figure 1**, a pictorial representation of a distributed data processing system is depicted in which the present invention may be implemented. Distributed data processing system

100 is a network of computers in which the present invention may be implemented. Distributed data processing system 100 contains network 102, which is the medium used to provide communications links between various devices and computers connected within distributed data processing system 100. Network 102 may include
 5 permanent connections, such as wire or fiber optic cables, or temporary connections made through telephone connections.

In the depicted example, server 104 is connected to network 102, along with storage unit 106. In addition, clients 108, 110 and 112 are also connected to network 102. These clients, 108, 110 and 112, may be, for example, personal computers,
 10 network computers, personal digital assistants, data network compatible cellular devices, cable or satellite TV set-top boxes, Internet ready game consoles, and the like. For purposes of this application, a network computer is any computer coupled to a network which receives a program or other application from another computer coupled to the network. In the depicted example, server 104 provides data, such as
 15 boot files, operating system images and applications, to clients 108-112. Clients 108, 110 and 112 are clients to server 104. Distributed data processing system 100 may include additional servers, clients, and other devices not shown.

In the depicted example, distributed data processing system 100 is the Internet, with network 102 representing a worldwide collection of networks and gateways that
 20 use the TCP/IP suite of protocols to communicate with one another. At the heart of the Internet is a backbone of high-speed data communication lines between major nodes or host computers consisting of thousands of commercial, government, education, and other computer systems that route data and messages. Of course, distributed data processing system 100 also may be implemented as a number of
 25 different types of networks such as, for example, an intranet or a local area network. **Figure 1** is intended as an example and not as an architectural limitation for the processes of the present invention.

Referring to **Figure 2**, a block diagram of a data processing system which may be implemented as a server, such as server 104 in **Figure 1**, is depicted in accordance

with the present invention. Data processing system **200** may be a symmetric multiprocessor (SMP) system including a plurality of processors **202** and **204** connected to system bus **206**. Alternatively, a single processor system may be employed. Also connected to system bus **206** is memory controller/cache **208**, which provides an interface to local memory **209**. I/O bus bridge **210** is connected to system bus **206** and provides an interface to I/O bus **212**. Memory controller/cache **208** and I/O bus bridge **210** may be integrated as depicted. Peripheral component interconnect (PCI) bus bridge **214** connected to I/O bus **212** provides an interface to PCI local bus **216**. A number of modems **218-220** may be connected to PCI bus **216**. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors. Communications links to network computers **108-112** in **Figure 1** may be provided through modem **218** and network adapter **220** connected to PCI local bus **216** through add-in boards. Additional PCI bus bridges **222** and **224** provide interfaces for additional PCI buses **226** and **228**, from which additional modems or network adapters may be supported. In this manner, server **200** allows connections to multiple network computers. A memory mapped graphics adapter **230** and hard disk **232** may also be connected to I/O bus **212** as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention. The data processing system depicted in **Figure 2** may be, for example, an IBM RISC/System 6000, a product of International Business Machines Corporation in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system.

With reference now to **Figure 3**, a block diagram of a data processing system in which the present invention may be implemented is illustrated. Data processing system **300** is an example of a client computer. Data processing system **300** employs a peripheral component interconnect (PCI) local bus architecture. Although the

depicted example employs a PCI bus, other bus architectures, such as Micro Channel and ISA, may be used.

Processor **302** and main memory **304** are connected to PCI local bus **306** through PCI bridge **308**. PCI bridge **308** may also include an integrated memory controller and cache memory for processor **302**. Additional connections to PCI local bus **306** may be made through direct component interconnection or through add-in boards. In the depicted example, local area network (LAN) adapter **310**, SCSI host bus adapter **312**, and expansion bus interface **314** are connected to PCI local bus **306** by direct component connection.

In contrast, audio adapter **316**, graphics adapter **318**, and audio/video adapter (A/V) **319** are connected to PCI local bus **306** by add-in boards inserted into expansion slots. Expansion bus interface **314** provides a connection for a keyboard and mouse adapter **320**, modem **322**, and additional memory **324**.

In the depicted example, SCSI host bus adapter **312** provides a connection for hard disk drive **326**, tape drive **328**, CD-ROM drive **330**, and digital video disc read only memory drive (DVD-ROM) **332**. Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

An operating system runs on processor **302** and is used to coordinate and provide control of various components within data processing system **300** in **Figure 3**. The operating system may be a commercially available operating system, such as Windows 2000, which is available from Microsoft Corporation. Windows is a trademark of Microsoft Corporation.

An object oriented programming system, such as Java, may run in conjunction with the operating system, providing calls to the operating system from Java programs or applications executing on data processing system **300**. Instructions for the operating system, the object-oriented operating system, and applications or programs are located on a storage device, such as hard disk drive **326**, and may be loaded into main memory **304** for execution by processor **302**.

Those of ordinary skill in the art will appreciate that the hardware in **Figure 3**

may vary depending on the implementation. For example, other peripheral devices, such as optical disk drives and the like, may be used in addition to or in place of the hardware depicted in **Figure 3**. The depicted example is not meant to imply architectural limitations with respect to the present invention. For example, the processes of the present invention may be applied to multiprocessor data processing systems.

Figure 4 illustrates a high level flow chart which depicts establishing a prioritized list of preferred providers for an individual marketplace in accordance with the present invention. The process starts as depicted by block **400** and thereafter passes to block **402** which illustrates establishing a list of all participating marketplaces. These are the marketplaces with which an individual marketplace may attempt to bilaterally clear orders. Next, block **404** depicts establishing a list of preferred providers. These are providers selected from the list of all participating marketplaces with which an individual marketplace prefers to conduct business. Thereafter, block **406** illustrates the individual marketplace prioritizing the preferred providers. The process then terminates as depicted by block **408**.

Figure 5 illustrates a high level flow chart which illustrates an individual marketplace receiving an order from a customer and attempting to clear the order utilizing other individual marketplaces in accordance with the present invention. The process starts as depicted by block **500** and thereafter passes to block **502** which illustrates an individual marketplace site receiving an order from a customer. Next, block **504** depicts an individual marketplace recording the order in that individual marketplace's local order book. Thereafter, block **506** illustrates a determination of whether or not the individual marketplace can match the order using its own, local order book. If a determination is made that the individual marketplace can match the order using its own order book, the process passes to block **508** which depicts the individual marketplace selecting the best matching order from its own local order book.

Block **510**, then, illustrates the individual marketplace clearing the order and

then removing it from the individual marketplace's order book. Thereafter, block **512** depicts the individual order book transmitting a confirmation slip to its customer.

Next, block **514** illustrates the individual marketplace transmitting an invoice to its customer.

5 Referring again to block **506**, if a determination is made that the individual marketplace cannot clear the order using its own local order book, the process passes to block **516** which depicts a determination of whether or not the individual marketplace has specified a list of preferred providers. If a determination is made that the individual marketplace has not specified any preferred providers, the process
10 passes to block **530**.

Referring again to block **516**, if a determination is made that the individual marketplace has specified preferred providers, the process passes to block **518** which illustrates a selection of the highest priority preferred provider. Next, block **520** depicts the individual marketplace locking its order in its local order book.

15 Thereafter, block **522** illustrates the individual marketplace transmitting information about the order to the selected preferred provider. Block **524**, then, depicts a determination of whether or not the marketplace received a notice that the preferred provider was able to match the order in the preferred provider's order book or a notice that the preferred provider was not able to match the order in the preferred provider's
20 order book. In response to a determination that the marketplace received a notice from the preferred provider that it was not able to match the order, the process passes to block **526** which depicts a determination of whether or not there are any more preferred providers. If a determination is made that there are more preferred providers, the process passes to block **528** which illustrates a selection of a next
25 highest priority provider. Thereafter, the process passes back to block **522**. Referring again to block **526**, if a determination is made that there are no more preferred providers, the process passes to block **532**.

Referring again to block **524**, if a determination is made that the marketplace received a notice from the preferred provider that the preferred provider was able to

Referring again to block **530**, block **530** depicts the local marketplace locking the order in its local order book. Next, block **532** illustrates the local marketplace broadcasting information about the order to all participating marketplaces. Block **534**, then, depicts a determination of whether or not the local marketplace received information about one or more matching orders from one or more other marketplaces that the other marketplace was able to match the order. If a determination is made that the local marketplace did not receive information about any matching orders, the process passes to block **550** which illustrates the local marketplace unlocking the order in its local order book. The process then passes to block **506**. Referring again to block **534**, if a determination is made that the local marketplace did receive information about one or more matching orders from one or more other marketplaces, the process passes to block **536**.

Referring again to block **538**, if a determination is made that there is at least one remaining matching order, the process passes to block **540** which illustrates the marketplace selecting one or more best orders from the remaining orders. The process then passes to block **542** which depicts this local marketplace transmitting information about these selected one or more orders to the originating marketplaces. For example, if the local marketplace received a notice of a matching order from another marketplace, the local marketplace will transmit information about a selection

of this order to the other marketplace. If the local marketplace received a notice of a matching order from more than one other marketplace, and if the local marketplace chose multiple orders, the local marketplace will transmit information about a selection of these orders to the other marketplaces.

5 Next, block **544** depicts a determination of whether or not the local marketplace received a confirmation from each marketplace to which a selection was transmitted. If a determination is made that the local marketplace did receive a confirmation from each marketplace to which information about a selection was transmitted, the process passes to block **510**.

10 Referring again to block **544**, if a determination is made that the local marketplace has not received a confirmation from each marketplace to which information about a selection was transmitted, the process passes to block **548** which depicts the local marketplace removing the information about this order from the remaining matching orders. The process passes to block **538**.

15 **Figure 6** illustrates a high level flow chart which depicts an individual marketplace attempting to clear orders received from another individual marketplace in accordance with the present invention. The process starts as depicted by block **600** and thereafter passes to block **602** which illustrates a receiving marketplace receiving information about an order from an originating marketplace. Next, block **604** depicts
20 the receiving marketplace searching its local order book for one or more matching orders. The process then passes to block **606** which illustrates a determination of whether or not the receiving marketplace found any orders posted in its local order book which match the received order's product. If a determination is made that there are no orders posted in the receiving marketplace's local order book which match the
25 received order's product, the process passes to block **608** which depicts this marketplace transmitting a notice to the originating marketplace where the received order originated that no matching orders exist. The process then passes to block **602**.

Referring again to block **606**, if a determination is made that there is at least one order in the receiving marketplace's local order book which matches the received

order's product, the process passes to block **612** which illustrates the receiving marketplace selecting all orders in its local order book which match the requested product. Thereafter, block **616** depicts the receiving marketplace's local order book locking all of the selected orders. Next, block **618** illustrates the local order book transmitting a notice to the originating marketplace including details for each selected matching order. The process then passes to block **620** which depicts a determination of whether or not the receiving marketplace received a selection of one or more orders. If a determination is made that the receiving marketplace did not receive a selection of one or more orders, the process passes to block **622** which illustrates the receiving marketplace unlocking all orders which were locked in response to the receipt of this current order. The process then passes back to block **602**.

Referring again to block **620**, if a determination is made that the receiving marketplace did receive a selection of one or more orders, the process passes to block **624** which depicts the receiving marketplace unlocking all non-selected orders which were locked in response to receipt of this current order. The selected orders remain locked. Next, block **626** illustrates the receiving marketplace clearing the selected order(s) from the receiving marketplace's local order book. Thereafter, block **628** depicts the receiving marketplace transmitting a confirmation to the originating marketplace where the current order originated that the receiving marketplace did clear the order. Block **630**, then, illustrates the receiving marketplace transmitting a confirmation slip to the receiving marketplace's customer. Next, block **632** depicts the receiving marketplace transmitting an invoice to its customer.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard

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